2013 UDOT RESEARCH PROBLEM STATEMENT

****** Problem statement deadline is March 25, 2013. Submit statements to Steve Bagley at sbagley@utah.gov ******

Problem Title: Effect of Pile Head Geometry on Lateral Resistance **No. UT-13.04.06**

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Select a Subject Area

☒ Geotechnical	☐ Materials/Pavements	☐ Maintenance	☐ Traffic Mgmt/Safety
	☐ Preconstruction	☐ Planning/Asset Mgmt	☐ Transportation Innovation

1. Describe the problem to be addressed.

At a number of UDOT bridges, designers have used sleeved piles (piles within corrugated steel pipes or "cans") or plastic sheeting to reduce axial pile-embankment interaction because of dragload, equipment availability, or other issues. Sand or pea gravel is sometimes backfilled in the annular space between the can and the pile. Although these approaches may have been successful in dealing solving the immediate problem, recent testing suggests that they can negatively impact lateral resistance to significant but un-quantified degrees. Few if any test results are available to aid designers in selecting appropriate reduction factors for these conditions. As a result, considerable uncertainty is involved in the selection of appropriate soil parameters for lateral pile analysis in these cases. Side-by-side comparison lateral load tests are necessary to provide guidance for these cases which are becoming more common.

2. Describe why this research is important and how it is unique.

Lateral pile resistance is important for seismic conditions and for thermal expansion and contraction with integral bridge abutments. Designers are currently making recommendations without a firm basis for their assumptions. Little or no information on this issue is available from the technical literature or from comparison tests. No guidance is provided in code language. Comparison field tests will provide ground truth information which can be very useful when this issue is encountered in future projects. Pile tests can be conducted on reaction piles for the "Piles Near MSE Wall" study to reduce overall project cost.

3. List the research objective(s) to be accomplished:

1. Determine lateral resistance of pipe piles in cans with sand and pea gravel backfills.
2. Determine lateral resistance of pipe piles with double plastic sheeting
3. Provide design guidance on realistic soil parameters to account for the measured resistance in LPILE analyses.

4. List the major tasks to accomplish the research objective(s):

1. Instrument test piles for load testing (strain gauges and deflection vs. depth measurements)
2. Conduct comparative lateral load tests (conventional pipe pile, pile in can with sand backfill, pile in can with pea gravel backfill, pile with double plastic sheet wrapping.) to develop lateral load vs. displacement curves and bending moment vs depth curves.
3. Make comparison between tests and perform back-analysis using LPILE to determine appropriate soil parameters and potential composite action.
4. Perform parametric analyses to assess potential variations
5. Develop design recommendations for lateral resistance of piles with these geometries.

5. List the deliverable(s) to come to UDOT from this research study:

1. Test result summary report
2. Design recommendations for LPILE analysis for piles with these geometries

6. Describe how the results of this study will be implemented at UDOT.

The recommendations regarding soil parameters for these conditions in typical UDOT approach fill materials will be included in the UDOT design manual.

7. Estimated cost - Total: $30,000 **UDOT Share:** $ **Other/Matching Funds:** $

8. Outline the proposed schedule for this study, including estimated start date, duration, and major event dates.

Lateral load testing could start as early as Summer 2013 but could be delayed until Spring 2014 for second round of lateral load tests at MSE test wall at Geneva Rock Point of the Mountain pit. The anticipate schedule would be as follows:

Instrumentation -1 month
Lateral Load Testing – 1 month
Data Reduction – 1 month
LPILE Back-Analysis and parametric analysis – 1 month
Report preparation – 2 months

Total time – 6 months